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Industrial Specialisation and Productivity Catch-Up in CEECs

- Patterns and Prospects -

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Suggestions and comments on the research results presented are very welcome.

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Abstract

This paper establishes an empirical model of CEEC's industrial labour productivity growth determined by patterns of specialisation in manufacturing industries and the extent of backwardness. This model is then applied to predict potentials of productivity growth and prospects of productivity catch-up in two distinct scenarios of structural adjustment in EU accession states.

The predictions suggest that productivity catch-up will at the very least take more than two decades with Slovenia and the Slovak Republic arriving first. The Czech Republic and Hungary share similar catch-up prospects slightly more favourable as compared to Poland. The results for Estonia are bleak.

JEL: P, O
Keywords: Manufacturing industry, structural change, productivity growth, productivity gap, transition economies, catch-up

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Introduction - *Motivation of analysis*

More than a decade since systemic change, the most advanced EU accession economies in Central East Europe (CEECs) are today well integrated into the World market in general and the European one in particular. Between industrial producers in East and West, significant production networks have evolved, not least in the form of foreign direct investments. A largely liberalised foreign trade between EU accession candidates and member countries as well as the geographical proximity between western and eastern producers and customers suggest vivid technology transfer from West to East. The high level of industrial experience in the East inherited from their industrialised past allows technology transferred from the West to be readily implemented in production in the East.

Since EU accession countries have overcome their transformational recession, labour productivity growth in CEEC's industrial sectors has impressively outpaced growth in the West. Non-the-less, large gaps between labour productivities in the two integrating regions still persist and the question arises as to what the individual country's prospects for productivity catch-up are, judged from the conditions prevailing today.

To provide an account of catching up potentials and prospects in accession candidates, the analysis focuses on the respective patterns of specialisation in the manufacturing industries of the countries assessed. The assumption is that industrial structures having emerged in the course of the process of real economy integration can explain the previous records of productivity growth and that future structural patterns can likewise determine the accession country's prospects of productivity catch-up: patterns determine prospects.

In empirical research on transition economies, this is a largely underdeveloped field despite its clear relevance, especially for the assessment of future EU structural and cohesion policy in newly admitted members.

Data and methods

Empirical analysis of industrial structures is very sensitive to the data used and the methods applied. In order to allow comparability of results across the countries assessed, most data is taken from the EUROSTAT databases: here, statistics are harmonised and allow a high level of comparability across countries. The downturn of this source is that available data is not very up-to-date: the analysis can only draw upon statistics up to the year of 1998 for 3-digit data and 1999 for 2-digit data. Some of the missing data was complemented by OECD and official national statistics. Levels of industrial labour productivities are calculated as the ratio between the sum of value added in the industrial branches of manufacturing per number of people working in these branches. Labour productivities are not corrected for the intensity of use of factors (as

e.g. hours worked by employment), as comparable estimates for this do not exist - comparability of results across the countries analysed is deemed more important in this analysis.

The level of disaggregation in empirical studies depends on the availability of data[1]: our analysis uses 2 digit NACE data for value added and employment to calculate branch productivities, and 3 digit NACE data of employment shares or, where such is not available, value added shares for the classification of branches into the taxonomy for specialisation.[2] In the cases of Poland and Estonia, classification into the taxonomies was carefully done with 2-digit employment figures, as here a lower level of disaggregation was not available. Of course, the price to pay was that some overlapping of branches belonging to more than one class had to be dealt with in a case-by-case manner. Exchange rates are corrected by purchasing power estimates, as we expect the currencies of CEECs to be in general rather undervalued *vis-à-vis* the EU - living expenses are clearly lower.[3]

Outline of the paper

The paper is organised as follows: after providing a brief overview of manufacturing labour productivity levels and growth in the EU accession states of Estonia, Poland, the Czech and Slovak Republics, Hungary and Slovenia, and the average for the 15 current EU member states, an empirical model of productivity growth determined by patterns of manufacturing specialisation and the degree of backwardness is estimated. The model is developed and discussed in part 2. The final part of this paper uses this model to estimate future potentials for productivity growth and catch-up prospects for each of the EU accession countries in our panel. This is done in two scenarios of future structural change, one assuming the emergence of a distinct pattern of specialisation and the other assuming structural convergence. The paper closes with a brief summary of main results pertaining to the expected speed of productivity growth and catch-up in the countries assessed.

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1 This not only applies to CEECs. The EUROSTAT Cronos database on western European countries is in some cases just as incomplete. Not only is national production-related or employment data often not yet harmonised. Data at a level of disaggregation of below the 2 digit NACE level is often perceived as being too imprecise by national statistical offices to warrant their publication.

2 Of course, shares calculated by employment figures will yield somewhat different results than shares calculated by value added figures. This is due to the fact that levels of productivity differ between classes of manufacturing branches.

3 This correction is to allow international comparison and is not motivated by the expectation of long-term convergence of prices and exchange rates (as in the purchasing power parity concept of some exchange rate theories).

1 Stylised facts: gaps in industrial labour productivity and productivity growth in CEECs

Some 10 years after the countries in Central East Europe switched to a competitive system and integrated into the European economic region, and despite impressive growth since, large differences in labour productivities between their industries and the ones in western Europe still exist. As a member of the group of most advanced transition countries, Estonia's industry exhibits with 14,400 € a level of industrial labour productivity as low as some 29 *per cent* of the respective average EU-15 level of 49,500 € (see Table 1). Amongst the countries in the panel of this analysis, Estonia has the least developed industrial sector.

Having started systemic transformation a couple of years later than the other countries assessed here, Estonia was clearly outpaced in industrial productivity growth by all other countries in our panel (Table 2). Poland is the country with the lowest share of employment in manufacturing industry amongst the countries in our panel. In 1999, Poland's industrial productivity reached some 20,200 € per employment, which compares to 41 *per cent* of the average EU-15 level. Industrial productivity growth accelerated in particular during the last few years, parallel to the unprecedented increase in foreign direct investment (FDI) into Polish industry as well as intensifying industrial restructuring, indicated by a decline (in absolute and relative terms) in industrial employment from 1998 onwards.

Hungary's de-industrialisation started much earlier in the process of transition and integration; the country experienced a turn-around already in 1996.[4] Here, however, productivity growth abated somewhat in the last few years in line with recovering industrial employment. This is also paralleled by a steady decline in net FDI inflows from 1996 onwards, *i.e.* in the aftermath of Hungary's stabilisation programme of 1995 and growing repatriation of profits from FDI.[5] In 1999, the Hungarian productivity level reached some € 23,300, slightly more than 47 *per cent* of the average EU-level.

The Czech Republic started in 1993 from about the same level as Hungary. By 1999, however, the Czech productivity level only reached some € 22,000. This weak performance could be held to be a result of the mass voucher-privatisation method which delayed technological modernisation and organisational restructuring. It can furthermore be attributed to the country's financial crisis in 1997: in it`s aftermath, industrial labour productivity levels fell significantly.

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[4] Incidentally, Hungary is the only country in the sample to have experienced industrial employment growth in absolute numbers since transformational recession.

[5] Recently falling net FDI inflows into Hungary can mainly be attributed to the end of the privatisation process.

Table 1 Levels of industrial labour productivity in selected countries

	in PPP €		in % of EU-15	
	1993	1999	1993	1999
Estonia	7 500	14 400	16.5	29.1
Poland	13 300	20 200	29.3	40.8
Czech Republic	15 800	22 000	34.8	44.4
Slovak Republic	11 700	21 700	25.8	43.8
Hungary	15 800	23 300	34.8	47.1
Slovenia	17 100	28 000	37.7	56.6
EU-15	45 400	49 500	100.0	100.0

Sources: EUROSTAT, OECD, WIIW, National Statistical Offices, own calculations.

In the case of the Slovak Republic, industrial productivity kept growing year by year: during the early years of transition, productivity grew by an astonishing 15 *per cent* per year on average. Growth, however, deteriorated later on as a result of the financial crisis in the neighbouring Czech Republic.

Slovenia's economy has a comparatively large industrial sector and outclasses the other countries with the highest industrial productivity level in 1999 at some 28,000 €. Still, this only compares to some 57 *per cent* of the EU-15 level. Slovenia also sticks out as the only country in the sample not to experience the typical hype of productivity growth rates during the early years following transformational recession.[6] Rather, its industrial productivity growth rates kept on increasing over time.

Table 2 Growth of industrial labour productivity in selected countries

	in average GDP-deflated growth rates *per anno*, in %		
	1996/1993	1999/1996	1999/1993
Estonia	-3.7	12.7	3.8
Poland	4.0	6.0	5.3
Czech Republic	9.2	0.7	5.0
Slovak Republic	15.4	3.8	10.5
Hungary	6.4	2.9	5.0
Slovenia	6.6	6.8	7.4
EU-15	2.5	1.4	1.9

Sources: EUROSTAT, OECD, WIIW, National Statistical Offices, own calculations.

[6] Which, in the other countries assessed here, can be attributed mainly to labour shedding as a means to increase cost-competitiveness on the new markets.

In general, CEEC's industries today still exhibit sizeable gaps in industrial labour productivities, achieving no more than 30-60 *per cent* of the average EU-15 level. Productivity growth in CEECs by far outpaced that of the average EU-15, but even those above-average rates would be associated with *e.g.* at least one decade before Slovenian productivity caught up to the average EU-15 level. If past rates are used as a yardstick, the time-span needed for catching up in the case of Poland would amount to even three times that of Slovenia.

What are the sources of productivity gaps and their development? Clearly, history will play a significant role: in technological terms, the socialist countries had been disconnected from developments in the West. Today, technology employed in production substantially differs from production in western Europe. This prominently concerns embodied technology in the capital stocks of CEECs. Moreover, criteria for the allocation of labour had been different during the socialist era, and some of this can be expected to prevail even today. Transformational recession was dominated by downward adjustment of industrial employment, but even today, we can assume that this adjustment process is not complete. The historical bias of vertical integration of domestic industrial production only slowly changes to allow heightened specialisation, diversification, division of labour and increased networking and outsourcing activities.

Despite some ten years since the outset of systemic change and the fundamental changes associated with transition and integration, the above outlined sources of productivity gaps tend to exhibit some hysteresis: capital replacement takes time, as profitability usually is a precondition for investment; people and institutions tend to resist changes in habits and beliefs. Alas, changes to these determinants will increase efficiency in the use of scarce resources, and will speed up productivity growth and catch-up.

In contrast, this is not necessarily the case with changes to the structural composition of manufacturing industry in the course of adjustment to integration and increased intensity of competition. Structural changes can have either effect on productivity growth: they will affect average industrial productivity adversely, if the share of branches with typically lower levels of productivity increases and *vice versa*. It is the composition and the shifts in shares of particular classes of manufacturing branches as country-specific determinants which are being assessed in terms of their influence on productivity growth in this analysis.

2 The empirical model of productivity growth determined by specialisation-patterns and the extent of backwardness

Research on specialisation-matters typically focuses on a theoretical explanation of emerging specialisation-patterns by use of models of the tradition of Heckscher-Ohlin or Ricardo. Some more recent literature attempts to use New Trade and New Growth Theories (see *e.g.* the large body of literature by Grossman-Helpman, Krugman, Puga

and Venables), but usually falls short of expectations in terms of an empirical application of these concepts. With the demise of structuralism as a theoretical concept of development economics (see body of literature by Prebish), very little theoretical research proceeds from there to interpret specialisation-patterns in terms of conditions for economic catch-up. This research matter is largely non-existent in empirical applications. At most, empirical research examines whether industrial structures are either 'advantageous' or 'disadvantageous', without however providing a sound theoretical framework.[7]

The main deficiency with this weak theoretical conceptualisation lies in the fact that it remains unclear, whether 'disadvantageous structures' are in fact general weaknesses which could hamper catching up. First, specialisation-patterns are broadly the result of a market-driven process in which the factors had been allocated according to the criterion of highest efficiency and therefore would represent the highest achievable level of structural competitiveness. These are determined by conditions prevailing in the respective economic regions. Second, development theories typically foresee market-mechanisms of convergence, be they rooted in the adjustment of relative prices (*e.g.* the factor price equalisation theorem)[8] or in structural adjustment caused by differing demand elasticities with growing income.[9] There remain, however, several question marks with such scenarios: mainly, it is unclear, whether economic catch-up will in effect take place, or more pragmatically, will take place in a sufficiently short period of time. Also, thinking in terms of specialisation between countries, it is perceivable that increased demand for products at the higher end of the above specified spectrum is satisfied by way of imports - the given specialisation then exhibits hysteresis and structural current account deficits emerge, possibly leading into a development trap.[10]

Some theoretical models, predominantly based on endogenous growth theories and economic geography concepts, perceive the possibility of catching up not taking place in particular conditions due to externalities, non-perfect competition, path dependence, and hysteresis (*e.g.* 'North-South', 'core-periphery' models, Krugman's and Posner's 'technology gap' and 'imitation gap' models, 'product life cycle theories', 'quality ladder' concepts, Snower's 'low-skill, bad-job trap' model, see Wolfmayr-Schnitzer

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7 See *e.g.* Peneder (2000), p. 21, and Zeman (2002). A more demanding approach is used by Mickiewicz and Zalewska (2002) on a sectoral level. Here, a particular theory from the de-industrialisation debate is applied on the cases of transition economies.

8 For a critical assessment of the Heckscher-Ohlin concept on the particular case of East Germany, see Brakman / Garretsen (1994).

9 With disposable incomes and entrepreneurial profits growing (or as mark-up in combination with Verdoon's law in a Kaldorian model, see *e.g.* Fiorillo, 2001), structural patterns are predicted to change to reduce perceived structural weaknesses: relative demand for and relative production of products at the lower end of the productivity, technology and skill spectrum will decrease and grow for products at the other end.

10 For an analysis of specialisation patterns leading to virtuous *versus* vicious circles involving exchange rate regimes, current account balances, and degrees of openness, see Pieper (1998).

(1999) for a literature-review of integration theories). In general, however, such models remain largely theoretical and do not lend themselves to a convincing empirical analysis.

Neither can therefore our analysis make use of a rigid theoretical framework. Rather, the empirical analysis inductively generates a model of productivity growth determined by specialisation-patterns and the respective productivity gaps. This model is then used to assess future prospects for productivity growth and catch up in the countries assessed.

The structural composition of manufacturing industry determines productivity growth during integration through two interactive channels: first, structures change in the course of economic integration. This is an aggregate effect of product or branch-differentiated firm entry and exit adjustment processes triggered by intensifying competition. A new pattern of division of labour emerges between the integrating partners. With the number of firms of higher productivity levels increasing (possibly at the detriment of firms at the lower end of the productivity spectrum), the average aggregate productivity level will increase without one firm actually increasing productivity itself (and *vice versa*). This can be thought of as a Schumpeterian process of creative destruction.

Second, average aggregate productivity growth from sources rooting in existing and efficiency-improving firms, like technology transfer and implementation, R&D, innovation and cost-rationalisation, also depends on structural patterns: the more firms in any given industry which belong to a class with typically high potentials for productivity growth, the larger is the base for productivity growth, the wider the potential. This can be thought of as a process of technological advancement, in the case of CEECs predominantly technological catch-up.

In this respect, labour intensive production and production typically less demanding on labour skills will be less prone to implement foreign technology, will produce less innovations, etc. On the contrary, more capital intensive firms, firms that need a large fraction of high skilled workers due to the kind of product or production processes, and firms that belong to a technology-intensive class typically generate higher productivity growth.[11] Finally, the extent, strategic aim and structural distribution of foreign direct investment into any country's industry will also depend on the structural composition of this country's industry: the availability of skilled employees is higher where a larger share of industrial workforce is engaged in more demanding jobs; the larger the base of supply industries, the larger will be the fraction of value added in the host country within the foreign direct investor's production chain, *etc.*

[11] In East Germany, the R&D-intensive sector exhibited a lesser speed in productivity catch-up to the West as compared to the less R&D intensive sector (BMBF, 2002, p. 57). This, however, can be considered an atypical result, possibly rooting in the large share of FDI in rather less R&D-intensive firms.

In the model constructed here, it is assumed that productivity growth in general roots from two distinct sources: first, productivity grows due to global technological change, *i.e.* what is termed in neo-classical growth theory the 'natural rate'. This is approximated here by the average productivity growth of the EU-15 in the more recent past and amounts to 1.9 *per cent* per year (see table 2). The second source of productivity growth is a feature of technological catch-up and is specialisation-determined in the sense outlined above.

The speed of technological catch-up in general depends on the actual extent of backwardness: in the concept of "advantages of backwardness", it is assumed that productivity growth will be faster in 'backward' countries than in countries at the contemporary technological frontier.[12] Hence, the second (specialisation-determined) source of productivity growth through technological catch-up is weighted across the time-scale and across countries according to the actual size of the individual productivity gap:

$$p_i^t = \bar{p}_{EU} + PG_i^t * p_{S,i}^t \quad (1.1)$$

$$p_{S,i}^t = f\ (specialisation\ patterns) \quad (1.2)$$

with p_i^t denoting productivity growth of country i in year t; $\bar{p}_{EU}$ the average productivity growth in the EU-15, PG_i^t the productivity gap of country i in year t *vis-à-vis* the average EU-15 level, and $p_{S,i}^t$ the part of productivity growth, empirically determined by specialisation-patterns in a model.

This specialisation and backwardness-determined productivity growth can best be assessed empirically in the framework of a taxonomy that groups industries or branches into classes according to homogeneous common criteria. The list of criteria used in this analysis is derived from trade and growth theories and includes labour intensity, capital intensity, skill intensity of workers, and technology intensity. The individual classifications used here are borrowed from the rich new WIFO taxonomy which provides a whole variety of different classifications (Peneder 1999, 2000). This taxonomy was empirically generated from a selection of mature OECD market economies. It was generated with a view on the competitiveness of EU firms and countries, and has the potential to replace other taxonomies used so far, as *e.g.* OECD (1994).

The use of branch-classifications for an analysis of transition economies has some advantages over a direct measuring of criteria at firm level first due to non-availability of firm-level data. Second, the construction of a taxonomy by use of mature market

[12] Available technology can be implemented via imitation. Backward countries have the advantage of being able to improve their performance without having to invest into own innovations. See Gerschenkron (1962), or product cycle theories.

economies allows a correction of possible distortions in manufacturing branches in transition economies in respect to the criteria: it is to be expected that some branches in transition economies in fact take 'unusual' values for the criteria assessed which could root in their socialist past. These values have to be treated as 'unusual' for a prognostic analysis, as they are most likely to adjust to 'normal' values in the process of intensified integration. After all, the 'normal' values of criteria within classes have been deducted from conditions amongst competitive firms in mature markets, and no doubt, transition economies will develop into countries with competitive firms due to their exposure in the common integration area of the EU - whatever the level of national GDP *per capita.* This way, this correction-function grants the taxonomy-method a higher level of prognostic quality.

A linear regression of productivity growth against the respective sizes of classes of specialisation, and corrected by extent of backwardness, provides an empirical model of productivity growth in transition economies in the recent past[13]:

$$p_i^t = \bar{p}_{EU} + PG_i^{t-1} \times (b_1^t\ LI_i^t + b_2^t\ CI_i^i + b_3^t\ (h-SI)_i^t + b_4^t\ (TI)_i^t) + u \qquad (2.1)$$

$$\frac{p_i^t - \bar{p}_{EU}}{PG_i^{t-1}} = b_1^t\ LI_i^t + b_2^t\ CI_i^i + b_3^t\ (h-SI)_i^t + b_4^t\ (TI)_i^t + u \qquad (2.2)$$

with LI_i^t denoting the share of labour intensive branches in the manufacturing industry of country i at the end of year t; LI_i^t the share of the class of labour intensive industrial branches, (CI) denoting capital intensity, $(h-SI)$ low-skill intensity, (TI) technology intensity, and PG_i^{t-1} the productivity gap of country i at the end of year *t-1*.[14]

It goes without saying that, methodologically, this model will best apply to the transition economies in the panel. Due to the consideration of a backwardness-criterion, it could, however, be used for more mature economies as well: *e.g.* for the technological leader, the model would predict productivity growth to equal the 'natural rate', as the extent of backwardness is zero. The results of the regression are presented in table 3.

In line with economic theory and with what plausibility would lead us to expect, the class of manufacturing branches composed of firms with typically high labour intensities is negatively associated with average industrial labour productivity growth. Capital

[13] During transformational recession at the outset of systemic change, specialisation patterns were subject to profound changes and will not have reflected any market-criteria. For the model to produce sensible and robust results, the period of analysis was chosen to start in 1993 and to extend to 1999. Data for specialisation patterns were only available for the two years of 1995 and 1998. The missing data was computed by extrapolation (trend line analysis).

[14] The one-period lag of productivity gaps in the model is a necessity, as gaps can only be computed after productivity growth had been calculated.

intensive, high skill intensive and technology intensive branches are all positively associated with productivity growth.[15]

Table 3 Results of regression models of classes of industrial branches and productivity growth in the pool of selected countries

	coefficient	t-statistic	adjusted R^2
Labour intensity	-0.12	-7.3	Weighted statistics:
Capital intensity	0.14	2.6	0.97
High-skill intensity	0.33	2.8	Unweighted statistics:
Technology intensity	0.54	10.4	0.66

Pooled least squares analysis (cross section weights) with 6 countries and 6 years (36 observations).

Due to the small number of observations, the R-square of the unweighted statistics only reaches 66 *per cent*. Still, this is considered sufficiently robust to warrant further analysis by use of this model: a test of the model's representation of observed productivity growth by estimated growth showed only small deviations.[16]

This enables the analysis to use the empirical model to estimate future potentials for productivity growth for each of the EU accession countries in the panel. For this, obviously, assumptions on the future development of structural patterns are necessary. Two scenarios are assessed: one assumes that the trends in the recent past will prevail in the short to medium term. This path-dependency scenario models a distinct pattern of specialisation emerging between the industries of CEECs and the EU in the course of intensifying integration. Here, logarithmic[17] trends extending existing data to the year of 2020 have been used, following the assumption that the most recent trend towards distinct patterns of specialisation (*i.e.* after the most severe de-industrialisation had been overcome) now reflect market conditions and country-specific conditions prevailing. Hence, trends are taken to indicate medium-term patterns of specialisation. In the second scenario, the opposite structural development is assumed, namely structural convergence: it is perceivable that in line with technological catching up, the industries of accession partners will engage in the kind of intra-industrial trade typical for the industries

[15] Comparable qualitative results for the classifications derived from WIFO were also obtained when constructing the taxonomy by use of a variety of empirical methods (see Peneder 1999, 2000).

[16] In fact, several other models with different groups of specialisation patterns have been estimated in an attempt to test the robustness of the regression model presented here. All models produced surprisingly similar results with respect to the quantification of catching up potentials.

[17] The advantage of logarithmic trends over linear trends in this case is that the intensity of structural changes can be expected to abate in the course of time: adjustment pressures will have been strongest at the outset of systemic transformation and liberalisation.

of most member states.[18] Here, the sizes of shares of the four classes converge to the sizes of classes prevailing in Germany[19] today by the year 2010.

3 Medium-term prospects for productivity growth and catch-up

Amongst the most prominent comparative advantages, CEECs can make use of significantly lower wages. Even after correcting for productivity differences, some advantage in lower labour costs remains.[20] Because, additionally, capital stocks in CEEC's industries tend to only gradually be upgraded technologically, we can expect that manufacturing production in CEECs to be comparatively less capital intensive and more labour intensive: firms producing tradable goods and succeeding on the enlarged European market will make use of lower labour costs by employing relatively more labour input to make up for the lower level of automatisation in production that their capital stock allows.[21]

A further deduction of this resource-based view is that production in CEECs will also tend to be distinct *vis-à-vis* the EU in terms of skill-intensity of employees: a technologically less advanced capital stock and relative abundance of labour in CEECs will make industrial production most competitive in branches which typically use less skilled workers. We expect CEEC's manufacturing in general to employ less high-skilled workers to operate machinery and rather to work more manually.

In fact, specialisation-patterns in CEECs as compared to Germany, match such expectations (table 4): the CEEC shares of branches belonging to the class of labour intensive manufacturing industries are much higher as compared to Germany, whereas the class of capital intensive branches is slightly underrepresented in most CEECs *vis-à-vis* Germany.

An exception is the Slovak Republic: here, low labour intensity in comparison to other CEECs is due mainly to much lower shares in manufacturing of wood, wood products and furniture, casting of metals and fabricated metal products, as well as lower shares of

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18 For an assessment of structures in trade between the industries of EU accession and members states, refer to Gabrisch / Segnana (2001). The results do not suggest structural convergence. Rather, a distinct pattern of vertical intra-industrial trade emerging between East and West would indicate the emergence of distinct specialisation patterns across the criterion of product quality (interpretable in the framework of the product-cycle concept).

19 Germany's industry is a good representative of the EU in this comparison, as the country is one of the main trading partners for CEECs and its manufacturing structures are well balanced with the ones for the average of the 15 current member states.

20 For a detailed empirical evaluation of CEEC's labour cost advantages, see *e.g.* Havlik (1998).

21 If a particular production does not lend itself to replace capital by labour (*i.e.* if production is limitational), then the producer will not be able to succeed on a market against competitors with better capital equipment and exit or not start at all in CEECs.

manufacturing of wearing apparels. The higher shares of capital intensive industries can be traced back to larger industries refining petroleum products, the first processing treatment of iron and steel, the manufacturing of basic precious and non-ferrous metals and of pulp and paper.

Table 4 Patterns of specialisation in manufacturing industries of selected countries in CEECs and average EU-15, in 1999

	Labour intensity	Capital intensity	High-skill intensity	Technology intensity
Estonia	42.4	5.7	7.4	5.8
Poland	30.7	9.5	10.5	7.1
Czech Republic	28.5	10.7	12.0	10.0
Slovak Republic	19.1	24.5	10.2	12.2
Hungary	25.5	11.2	9.8	12.1
Slovenia	22.3	9.1	12.3	16.0
Germany	19.6	10.4	16.9	20.7

Note: Values are given in shares of classes of branches of manufacturing industry. Estonia, Poland, the Czech Republic, Hungary and Germany's shares are measured as employment shares, the Slovak Republic and Slovenia's as value added shares (involving the comparative limitations described in footnote 2).

Sources: EUROSTAT, WIIW, National Statistical Offices, own calculations.

Furthermore, CEECs exhibit lower shares in high-skilled industries. In parallel, branches with a high technology intensity are underrepresented as compared to Germany. In general, Slovenia's and the Slovak Republic's structures of manufacturing industry are closest to the ones of Germany, and Estonia and Poland are furthest away. Do these results re-appear in the estimates of prospects for future productivity growth in our empirical model?

Extending, as described above, the trends of specialisation of manufacturing industries into the medium-term future in the two scenarios, the empirical model allows an estimation of future productivity growth for each country in the panel. The calculated rates of growth of industrial labour productivity and estimated productivity gaps are presented in table 5 for the years of 2004 and 2010 and for the two scenarios A and B, with scenario A being the specialisation-scenario and B the convergence-scenario (see also annexes 2.1 and 2.2 for a graphical representation of results). The year of 2004 represents the envisaged date of accession of (the first group of) CEECs. Then, the newly acceded countries will start to benefit from EU structural and cohesion fund policy. The first planning period for these policies will end 2010.

For most countries in our panel, the two scenarios produce significantly different results: catching up potentials are predicted much higher in the structural convergence-scenario,

as compared to the specialisation scenario. Here, the structures serve as retarding factors: labour intensity remains higher, capital intensity, skill and technology intensity lower. In scenario A, structures swiftly change to mirror the patterns in our benchmark country, hence predicted results are better. In particular: labour intensive branches (being associated with lower productivity growth potentials) adjust downwards or at a faster pace than in scenario A (compare annexes 1.1 and 2.1).[22] Additionally, in scenario B, technology intensities are on the rise or at a faster pace. Scenario B does not, however, produce greater productivity growth potentials with respect to capital intensity in the cases of the Slovak Republic and Hungary.

Structural composition and estimated trends in the Slovak Republic appear to be best suited for a speedy process of productivity catch-up in both scenarios. Assuming a *per anno* productivity growth in the EU of some 1.9 *per cent* (compare table 2) to account for the fact that catching up is a process towards a moving target, the Slovak Republic with the initially highest growth rates is predicted to reach a productivity level of nearly 60 *per cent* of the EU-average by 2004, and 75 *per cent*, the GDP *per capita* threshold for EU structural and cohesion funds policy[23], around 2010. The country with the highest starting level, Slovenia, is predicted to reach 75 *per cent* of the average industrial EU productivity level already around 2005.

Slovenia's predicted performance in scenario A is not significantly different from that in scenario B: this is due to the fact that the predicted structural development in scenario A comes close to structural convergence. The biggest differences between the results for either scenarios emerge for Poland and in particular for Estonia. Here, the specialisation-scenario predicts near stagnation. This despite the fact that the "advantages of backwardness" are highest for this country.

Estonia in general received the weakest results: starting from a very low level, and with specialisation-patterns in scenario A predicting the lowest and even falling growth rates, its productivity level will reach only some 33 *per cent* of the average EU-15 by 2010. In the convergence-scenario, productivity growth is estimated to reach much higher levels with a growing trend, and even surpassing all other accession countries. Yet the level achieved here by 2010 still only reaches 55 *per cent* of the average EU-15 level. Unless structures change more rapidly than anticipated by either scenarios (*e.g.* by way of increased FDI-activity), Estonia will not be able to catch up to the EU in any foreseeable time span. This bleak result might be partly accountable to the fact that Estonia started some years later with systemic transformations and with re-orientation towards the West. With structural adjustment processes through integration still being under way,

[22] In the Slovak Republic, labour intensity adjusts upwards at a slower pace in scenario B.

[23] It goes without saying that if labour productivity gaps remain below 75 *per cent*, industrial GDP per capita levels will not be able to be much higher, that is, unless unemployment rates reach very low levels and participation rates very high levels. In the case of Slovenia, the unemployment rate of 1999 was 13.5 *per cent* according to harmonised ILO - statistics.

Table 5 Estimated productivity growth (in average *per anno* growth rates) and estimated productivity levels (in EU-15 = 100) of selected CEECs

	Scenario A: Specialisation				Scenario B: Convergence			
	2004		2010		2004		2010	
	Growth 2004/1999	Level EU=100	Growth 2010/2004	Level EU=100	Growth 2004/1999	Level EU=100	Growth 2010/2004	Level EU=100
Estonia	3.0	30.3	2.6	31.1	7.3	36.0	11.8	54.6
Poland	5.3	46.8	4.9	53.7	7.8	51.5	9.1	70.7
Czech Republic	6.5	53.3	5.6	63.4	8.5	57.2	8.3	76.0
Slovak Republic	9.0	57.5	7.0	72.4	10.0	59.5	8.1	78.5
Hungary	7.2	58.0	6.3	70.9	8.3	60.3	7.7	78.4
Slovenia	7.4	70.1	5.6	83.2	7.8	71.2	6.0	86.2
EU-15	1.9	100	1.9	100	1.9	100	1.9	100

Note: Scenario A assumes distinct patterns of specialisation emerging from intensified integration. Scenario B assumes structural convergence to the benchmark of Germany; convergence is achieved by the year 2010.

Source: own calculations.

the empirical model in particular in scenario A might be biased. In any case, productivity growth rates well in excess of 15 *per cent* would be needed to bring the country closer to the results of the Slovak Republic and Slovenia.

In terms of catching up performance in both scenarios, Hungary and the Slovak Republic are estimated to fare nearly equally, despite the Slovak Republic starting from a lower base: in the convergence scenario, both countries could reach 75 of the EU-average by the year 2009, in scenario A some 2-3 years later. The specialisation trends predicted in scenario A for the Czech Republic are associated with a much slower pace of catching up as compared to the convergence scenario.

Poland's predictions are even less bright, albeit better than for Estonia in both scenarios: with growth rates comparable to the Czech Republic in scenario A and Hungary in scenario B, and a much lower starting level, Poland can expect to reach a level of some 50 *per cent* of the EU-average by 2006 in scenario A and by 2004 in scenario B.

Conclusions

This analysis attempted to estimate future productivity growth potentials and prospects of productivity catch-up in the manufacturing industries of EU accession states. An empirical model was estimated, using structural patterns and the extent of backwardness (in terms of the size of the productivity gap *vis-à-vis* the EU-15 average) as determinants of productivity growth. The results are presented for two scenarios with distinct assumptions concerning structural adjustment in the process of deepening integration and intensifying competition.

In such a methodological framework, the empirical model established significant differences in productivity growth prospects amongst the group of most advanced EU accession candidates: the prospects are clearly best for the Slovak Republic, and in particular even better than in Slovenia. Starting from a lower level as compared to Hungary, the Czech Republic and Poland, the Slovak Republic is predicted to surpass those countries in their catching up processes. This is especially pronounced in the first of the two scenarios, assuming the emergence of a distinct pattern of specialisation between EU accession and member states.

The worst productivity potentials and prospects are predicted for Estonia. Estonia not only starts from the lowest level of labour productivity in 1999, but its structural composition of manufacturing industries and the associated trends also grant the country the lowest estimated productivity growth rates. Poland also performs poorly in both scenarios of the estimated model. The Czech Republic is predicted to perform better, however clearly worse than Hungary.

If patterns of industrial structures in manufacturing determine potentials for industrial labour productivity growth and if structural patterns up until 1998 determine a trend of specialisation within the common integration area which can be extended into the future, *i.e.* if patterns, or

more precise: trends, exhibit hysteresis, then the empirical model predicts that productivity catch-up in accession states will take much longer than two decades. A productivity level of some 75 *per cent* of the EU-average is achieved in the case of Slovenia well before 2010, in the Slovak Republic, and Hungary slightly after 2010, and in the Czech Republic around 2018. The conditions prevailing in Estonia and Poland suggest that even a level of 75 *per cent* will not be reached in this kind of time-frame.

With more data being made available and with the generation of more experience in the real economy adjustment processes of economic transition emerging, the empirical model suggested in this paper will gain in terms of predicting power. Already now, the model is surprisingly robust for most of the countries assessed, lending support to the qualitative results generated.

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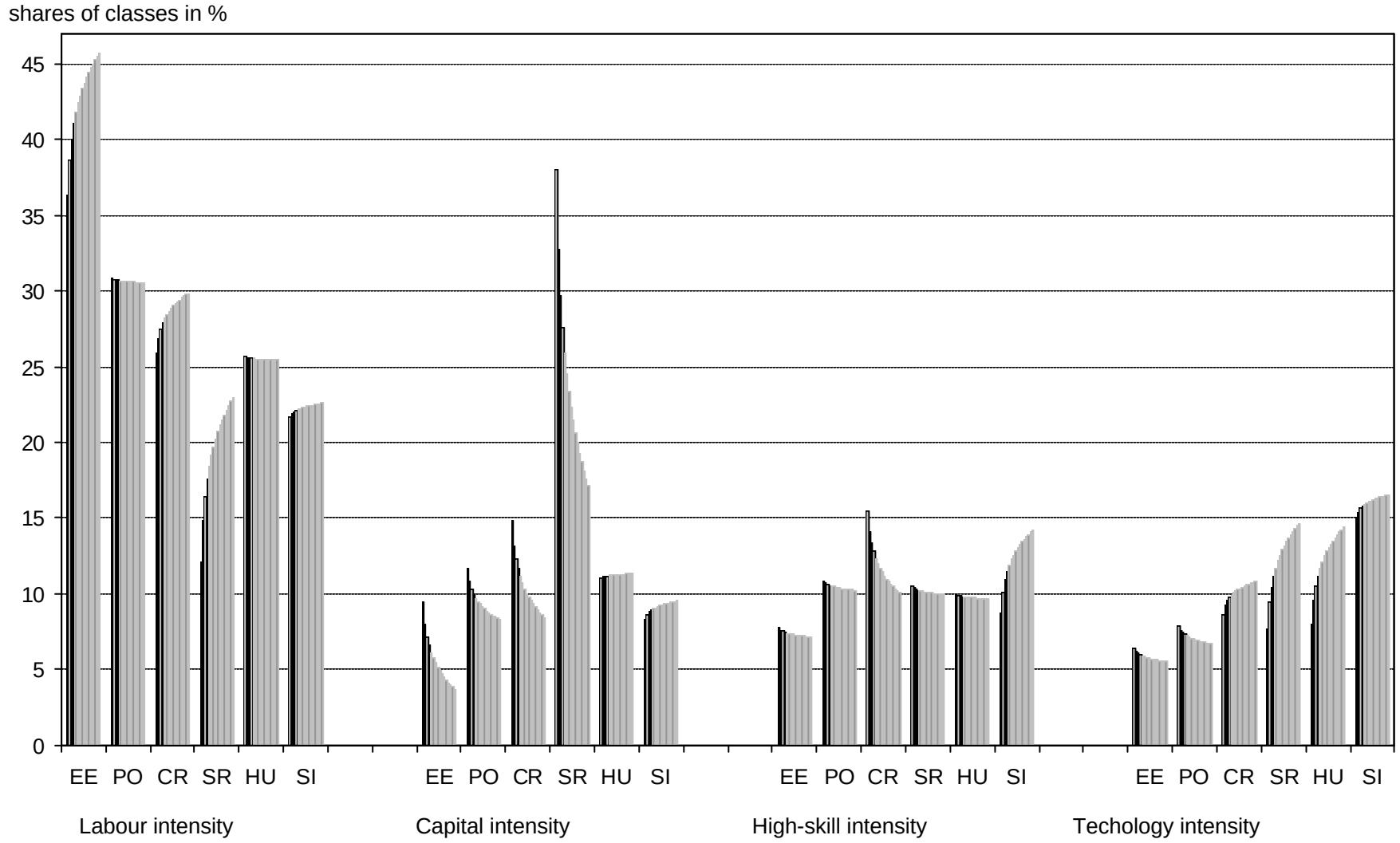
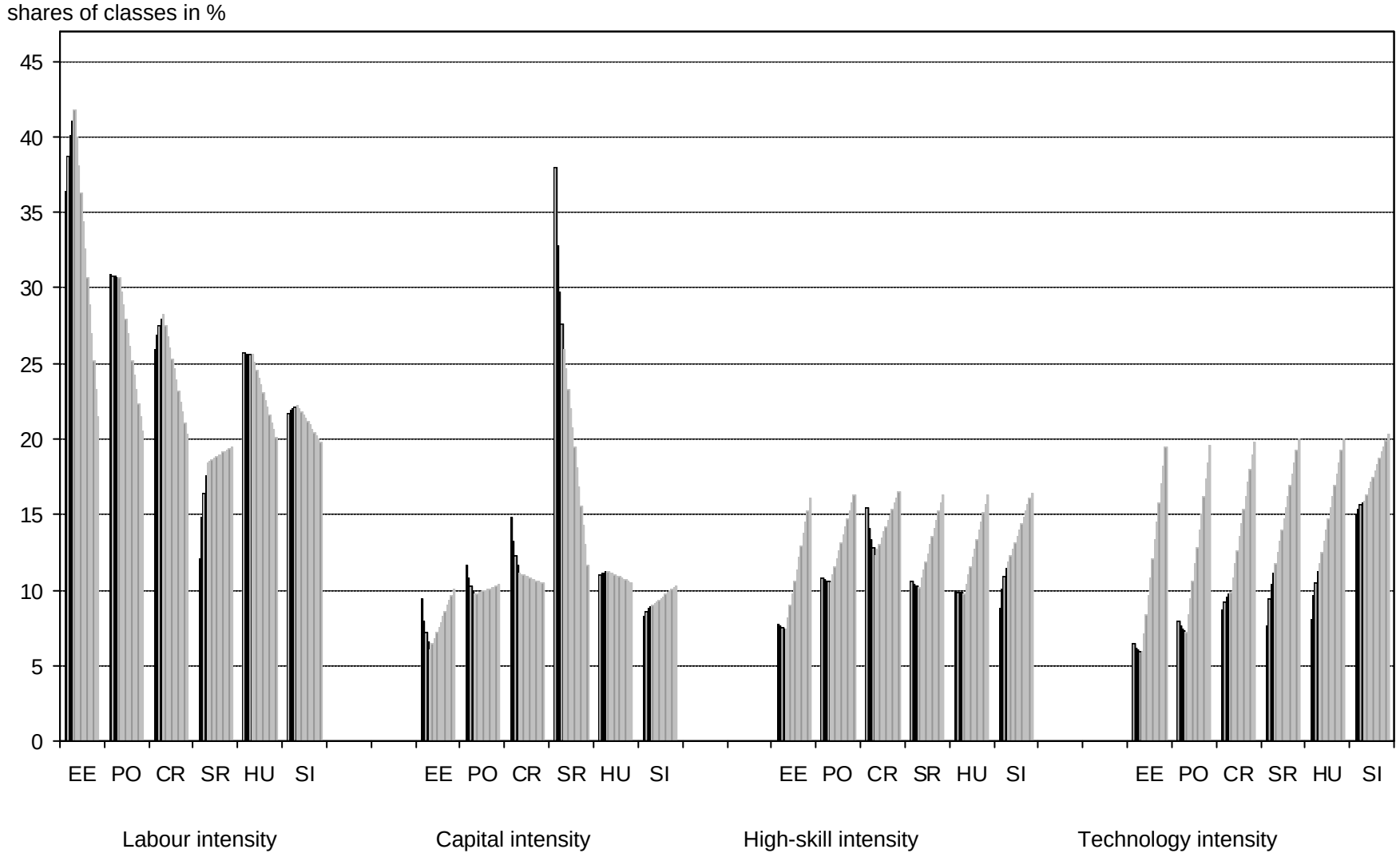
Annex 1.1:
Structural development in Scenario A (specialisation-scenario), 1994-2010



Note: Structural patterns from 1994 to 1999 are observed patterns, 2000 to 2010: estimated by use of logarithmic extrapolation of trends.

Annex 1.2:

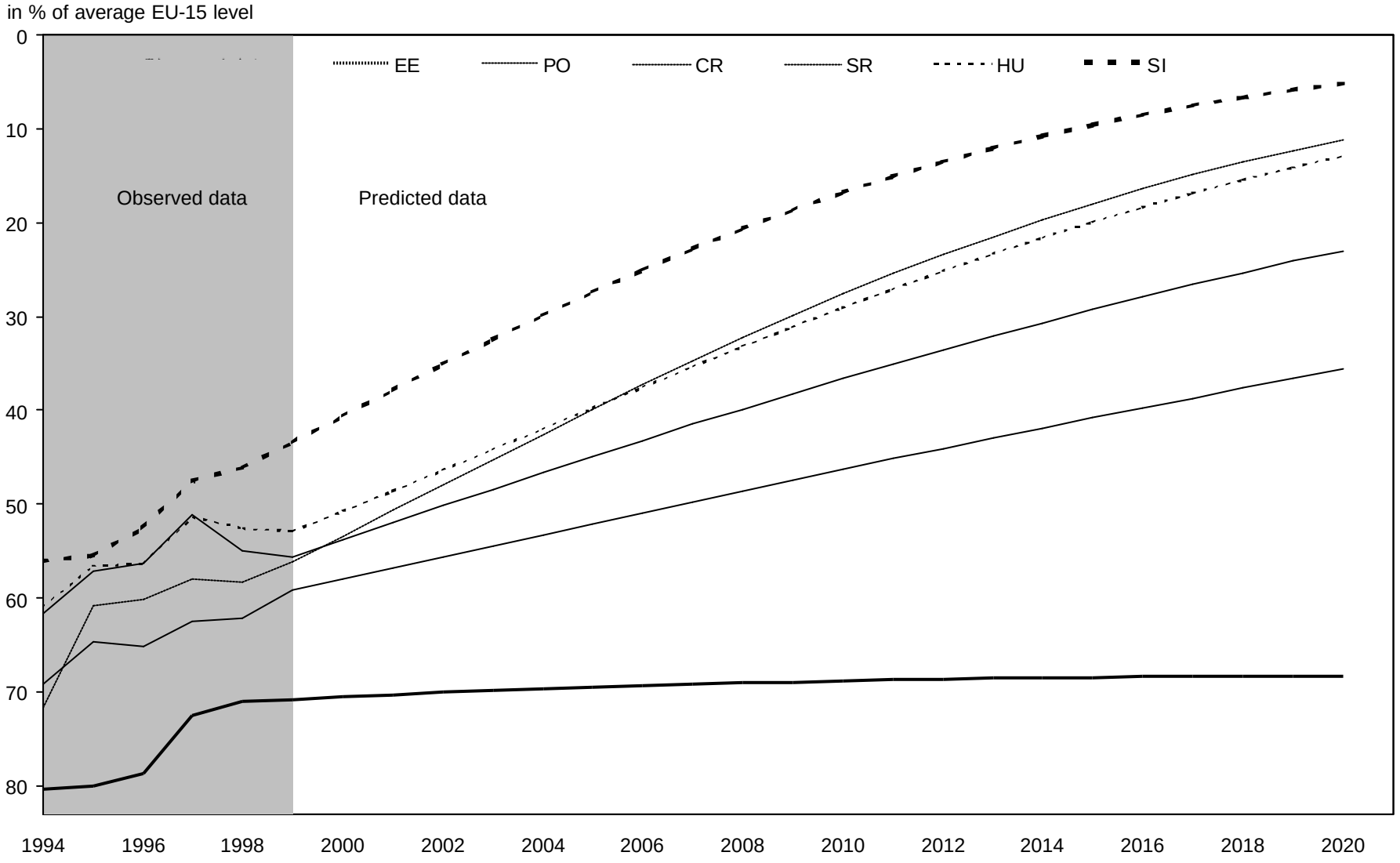
Structural development in Scenario B (convergence-scenario), 1994-2010



Note: Structural patterns from 1994 to 1999 are observed patterns, 2000 to 2010: estimated by use of logarithmic extrapolation of trends.

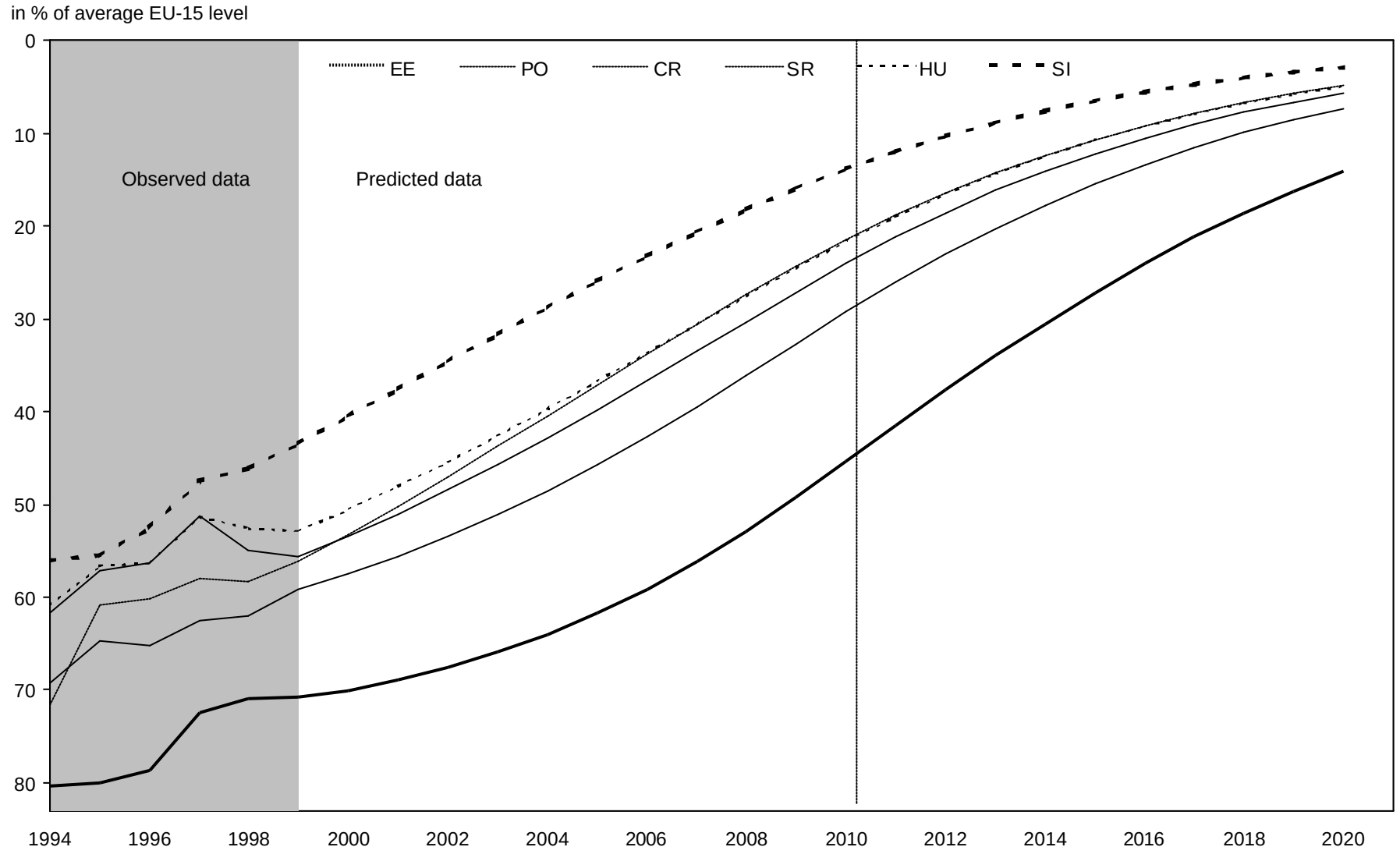
Annex 2.1:

Predicted paths of catching up: development of productivity gaps in Scenario A (specialisation-scenario), 1994-2020



Annex 2.2:

Predicted paths of catching up: development of productivity gaps in Scenario B (convergence-scenario), 1994-2020



Note: Structural convergence achieved by 2010. Further catch up solely due to the "advantages of backwardness".